

Fig. 1

A: write data
B: high order bit
C: low order bit
D: read data
3: control portion
4: bit switching portion
5: bit switching portion
6: write address counter
7: read address counter
8: address conversion portion
9: address conversion portion
10: address conversion portion
11: address conversion portion
12: address switching portion
13: address switching portion
14: address switching portion
15: address switching portion
16: read data switching portion

Fig. 4

A: write data
B: memory 1 write address
data
C: memory 2

Fig. 5

A: read data

B: memory 1 read address
data

C: memory 2

Fig. 6

A: 1st, 3rd, 5th, 7th rows: unchanged

B: 2nd, 4th, 6th, 8th rows: shifted one place

Fig. 7

A: 1st, 5th rows: unchanged

B: 2nd, 6th rows: shifted one place

C: 3rd, 7th rows: shifted two places

D: 4th, 8th rows: shifted three places

Fig. 8

A: 1st row: unchanged

B: 2nd row: shifted one place

C: 3rd row: shifted two places

D: 4th row: shifted three places

E: 5th row: shifted four places

F: 6th row: shifted five places

G: 7th row: shifted six places

H: 8th row: shifted seven places

Fig. 10

A: write data

B: memory 1 write address
data

C: memory 2 write address
data

D: read data

E: memory 1 read address
data

F: memory 2 read address
data

Fig. 11

A: write data

B: memory 1 write address
data

C: memory 2 write address
data

D: read data

E: memory 1 read address
data

F: memory 2 read address
Data

302: frequency-of-occurrence generating portion

303: memory

305: selector

A: compressed image data

B: Huffman code

C: decoded data

R1: register

C1: comparator

Ri: register

Ci: comparator

Fig. 17

302: frequency-of-occurrence generating portion

303: memory

321: constant storing portion

322: minimum code storing portion

323: code length detecting portion

324: selector

325: adder

A: Huffman code

B: frequency of occurrence

C: decoded data

D: code length

Fig. 18

100: DCT process portion
200: quantizing portion
206: Huffman encoding portion
400: quantization table
500: encoding table
800: reverse DCT process portion
700: dequantization portion
211: Huffman decoding portion
A: original image data
B: compressed image data
C: reproduced image data

Fig. 19

A: formation of blocks of image data
B: block

Fig. 20

A: 8 X 8 pixel block
B: DCT process
C: frequency

Fig. 21

110: one-dimensional DCT circuit
120: inversion memory
130: one-dimensional DCT circuit

Fig. 22

A: frequency in horizontal direction

B: frequency in vertical direction

C: low

D high

Fig. 23

A: zigzag scan

B: DCT coefficient

Fig. 24

A: raster scan (direction of rows)

B: raster scan (direction of columns)

Fig. 25

A: raster scan (direction of rows)

B: zigzag (direction of columns)

Fig. 26

221: bank memory

222: Huffman encoding circuit

Fig. 27

Eight cycles

Fig. 28

311: head search process portion

312: memory

(2^k words)

A: compressed image data

C: decoded data

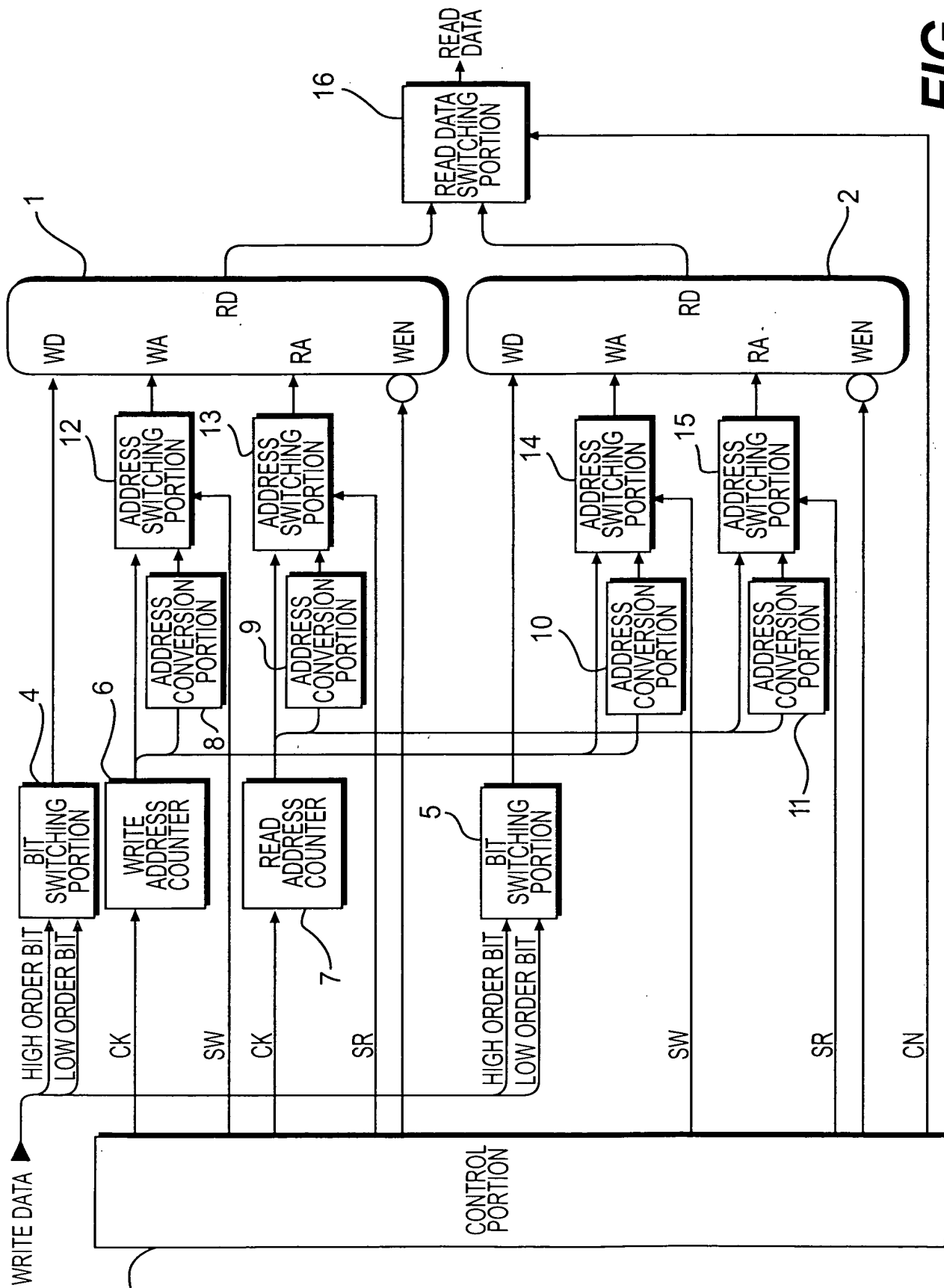


FIG. 1

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 2(a)

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 2(b)

0	1	2	3	4	5	6	7
9	8	11	10	13	12	15	14
16	17	18	19	20	21	22	23
25	24	27	26	29	28	31	30
32	33	34	35	36	37	38	39
41	40	43	42	45	44	47	46
48	49	50	51	52	53	54	55
57	56	59	58	61	60	63	62

FIG. 2(c)

0	0	2	4	6	0	1	3	5	7
4	9	11	13	15	4	8	10	12	14
8	16	18	20	22	8	17	19	21	23
12	25	27	29	31	12	24	26	28	30
16	32	34	36	38	16	33	35	37	39
20	41	43	45	47	20	40	42	44	46
24	48	50	52	54	24	49	51	53	55
28	57	59	61	63	28	56	58	60	62

FIG. 2(d)

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0	8	16	24	32	40	48	56
1	9	17	25	33	41	49	57
2	10	18	26	34	42	50	58
3	11	19	27	35	43	51	59
4	12	20	28	36	44	52	60
5	13	21	29	37	45	53	61
6	14	22	30	38	46	54	62
7	15	23	31	39	47	55	63

FIG. 3(a)

0	8	16	24	32	40	48	56
1	9	17	25	33	41	49	57
2	10	18	26	34	42	50	58
3	11	19	27	35	43	51	59
4	12	20	28	36	44	52	60
5	13	21	29	37	45	53	61
6	14	22	30	38	46	54	62
7	15	23	31	39	47	55	63

FIG. 3(b)

0	8	16	24	32	40	48	56
9	1	25	17	41	33	57	49
2	10	18	26	34	42	50	58
11	3	27	19	43	35	59	51
4	12	20	28	36	44	52	60
13	5	29	21	45	37	61	53
6	14	22	30	38	46	54	62
15	7	31	23	47	39	63	55

FIG. 3(c)

Figure 1 illustrates the first two steps of a 32-point FFT butterfly network. The figure consists of two 8x4 grids, labeled 1 and 2, connected by a curved arrow indicating the flow of data.

Grid 1 (labeled 1) shows the initial data distribution. The rows are labeled 0, 4, 8, 12, 16, 20, 24, 28. The columns contain the following values:

0	0	16	32	48
4	9	25	41	57
8	2	18	34	50
12	11	27	43	59
16	4	20	36	52
20	13	29	45	61
24	6	22	38	54
28	15	31	47	63

Grid 2 (labeled 2) shows the result after the first butterfly operation. The rows are labeled 0, 4, 8, 12, 16, 20, 24, 28. The columns contain the following values:

0	8	24	40	56
4	1	17	33	49
8	10	26	42	58
12	3	19	35	51
16	12	28	44	60
20	5	21	37	53
24	14	30	46	62
28	7	23	39	55

FIG. 3(d)

FIG. 4

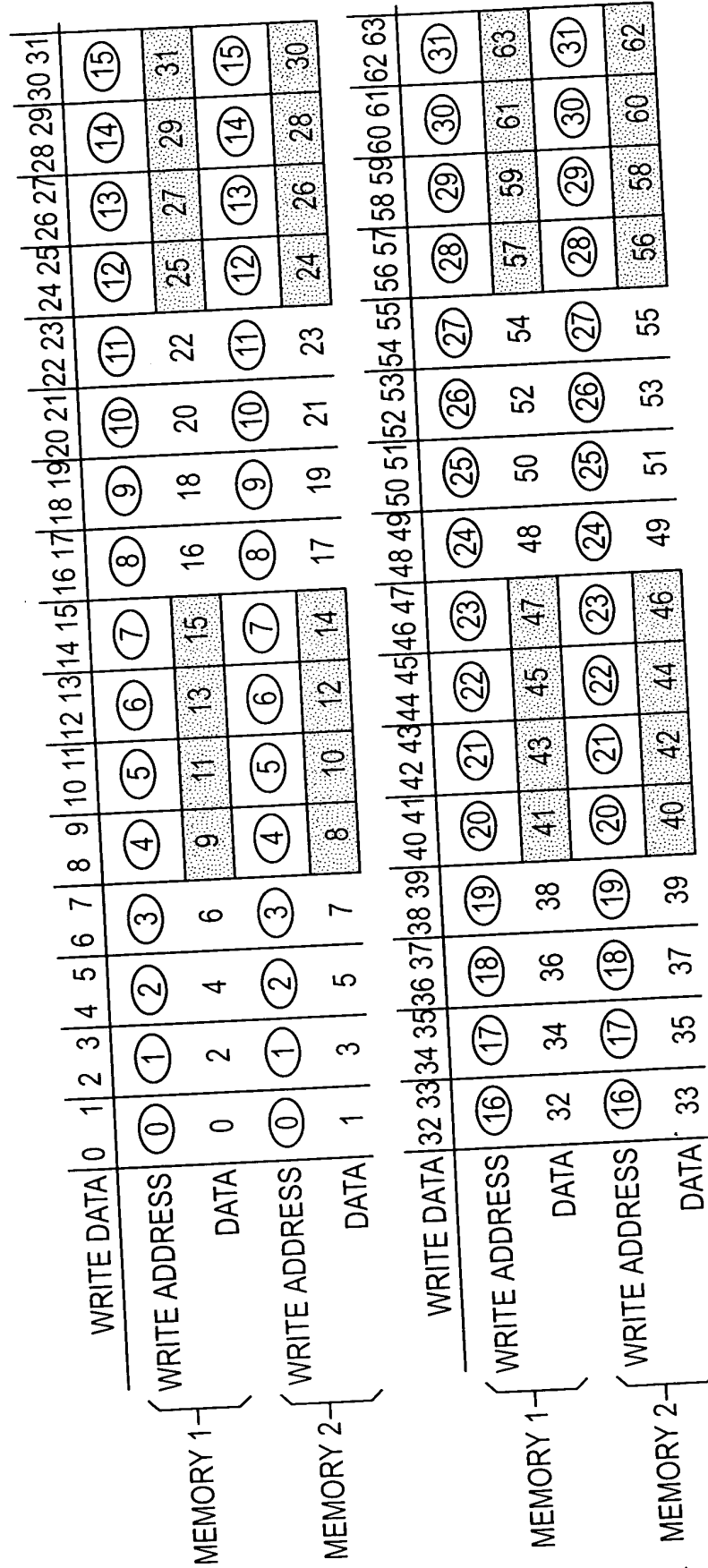


FIG. 4

READ DATA		0	8	16	24	32	40	48	56	1	9	17	25	33	41	49	57	2	10	18	26	34	42	50	58	3	11	19	27	35	43	51	59
MEMORY 1	READ ADDRESS	0	8	16	24	32	40	48	56	1	9	17	25	33	41	49	57	2	10	18	26	34	42	50	58	3	11	19	27	35	43	51	59
	DATA	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400	416	432	448	464	480	496
	READ ADDRESS	4	12	20	28	36	44	52	60	1	9	17	25	33	41	49	57	2	10	18	26	34	42	50	58	3	11	19	27	35	43	51	59
	DATA	8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296	312	328	344	360	376	392	408	424	440	456	472	488	504
READ DATA		4	12	20	28	36	44	52	60	5	13	21	29	37	45	53	61	6	14	22	30	38	46	54	62	7	15	23	31	39	47	55	63
MEMORY 1	READ ADDRESS	4	12	20	28	36	44	52	60	5	13	21	29	37	45	53	61	6	14	22	30	38	46	54	62	7	15	23	31	39	47	55	63
	DATA	4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244	260	276	292	308	324	340	356	372	388	404	420	436	452	468	484	500
	READ ADDRESS	8	16	24	32	40	48	56	64	1	9	17	25	33	41	49	57	2	10	18	26	34	42	50	58	3	11	19	27	35	43	51	59
	DATA	12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284	300	316	332	348	364	380	396	412	428	444	460	476	492	508
READ DATA		12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284	300	316	332	348	364	380	396	412	428	444	460	476	492	508
MEMORY 2	READ ADDRESS	12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284	300	316	332	348	364	380	396	412	428	444	460	476	492	508
	DATA	12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284	300	316	332	348	364	380	396	412	428	444	460	476	492	508
	READ ADDRESS	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400	416	432	448	464	480	496	512
	DATA	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400	416	432	448	464	480	496	512

FIG. 5

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

1ST, 3RD, 5TH, 7TH ROWS: UNCHANGED

2ND, 4TH, 6TH, 8TH ROWS: SHIFTED ONE PLACE

B0	B1	B0	B1	B0	B1	B0	B1
0	1	2	3	4	5	6	7
9	8	11	10	13	12	15	14
16	17	18	19	20	21	22	23
25	24	27	26	29	28	31	30
32	33	34	35	36	37	38	39
41	40	43	42	45	44	47	46
48	49	50	51	52	53	54	55
57	56	59	58	61	60	63	62



FIG. 6(a)

FIG. 6(b)

FIG. 6(c)

B0	B1	B0	B1	B0	B1	B0	B1
0	8	16	24	32	40	48	56
9	1	25	17	41	33	57	49
2	10	18	26	34	42	50	58
11	3	27	19	43	35	59	51
4	12	20	28	36	44	52	60
13	5	29	21	45	37	61	53
6	14	22	30	38	46	54	62
15	7	31	23	47	39	63	55

	B0	B1	B2	B3	B0	B1	B2	B3
0	8	16	24	32	40	48	56	
25	1	9	17	57	33	41	49	
18	26	2	10	50	58	34	42	
11	19	27	3	43	51	59	35	
4	12	20	28	36	44	52	60	
29	5	13	21	61	37	45	53	
22	30	6	14	54	62	38	46	
15	23	31	7	47	55	63	39	

	B0	B1	B2	B3	B0	B1	B2	B3
0	1	2	3	4	5	6	7	
11	8	9	10	15	12	13	14	
18	19	16	17	22	23	20	21	
25	26	27	24	29	30	31	28	
32	33	34	35	36	37	38	39	
43	40	41	42	47	44	45	46	
50	51	48	49	54	55	52	53	
57	58	59	56	61	62	63	60	

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

- 1ST, 5TH ROWS: UNCHANGED
- 2ND, 6TH ROWS: SHIFTED ONE PLACE
- 3RD, 7TH ROWS: SHIFTED TWO PLACES
- 4TH, 8TH ROWS: SHIFTED THREE PLACES

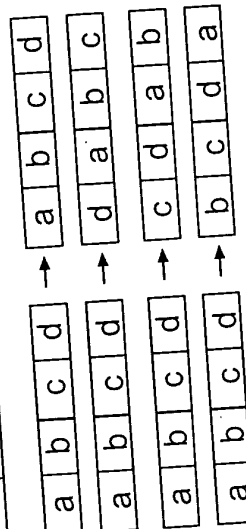


FIG. 7(c)

FIG. 7(b)

FIG. 7(a)



0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

37 00: UNCHANGED

1ST ROW: UNCERTAINTY

2ND ROW: SHIFTED ONE PLACES

3RD ROW: SHIFTED TWO PLACES

4TH ROW: SHIFTED THREE PLACES

5TH ROW: SHIFTED FOUR PLACES

6TH ROW: SHIFTED FIVE PLACES

7TH ROW: SHIFTED SIX PLACES

8TH ROW: SHIFTED SEVEN PLACES

[illegible]

FIG. 8(a)

	B0	B1	B2	B3	B4	B5	B6	B7
0	8	16	24	32	40	48	56	
57	1	9	17	25	33	41	49	
50	58	2	10	18	26	34	42	
43	51	59	3	11	19	27	35	
36	44	52	60	4	12	20	28	
29	37	45	53	61	5	13	21	
22	30	38	46	54	62	6	14	
15	23	31	39	47	55	63	7	
	a	b	c	d	e	f	g	h
	h	a	b	c	d	e	f	g
	g	h	a	b	c	d	e	f
	f	g	h	a	b	c	d	e
	e	f	g	h	a	b	c	d
	d	e	f	g	h	a	b	c
	c	d	e	f	g	h	a	b
	b	c	d	e	f	g	h	a

FIG. 8(b)

FIG. 8(c)

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0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 9(a)

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 9(b)

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0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 9(c)

0	0	9	10	11	12	5	6	7
8	16	17	26	27	28	29	30	23
16	32	41	42	43	44	45	38	39
24	48	49	50	59	60	61	62	55

0	8	1	2	3	4	13	14	15
8	24	25	18	19	20	21	22	31
16	40	33	34	35	36	37	46	47
24	56	57	58	51	52	53	54	63

FIG. 9(d)

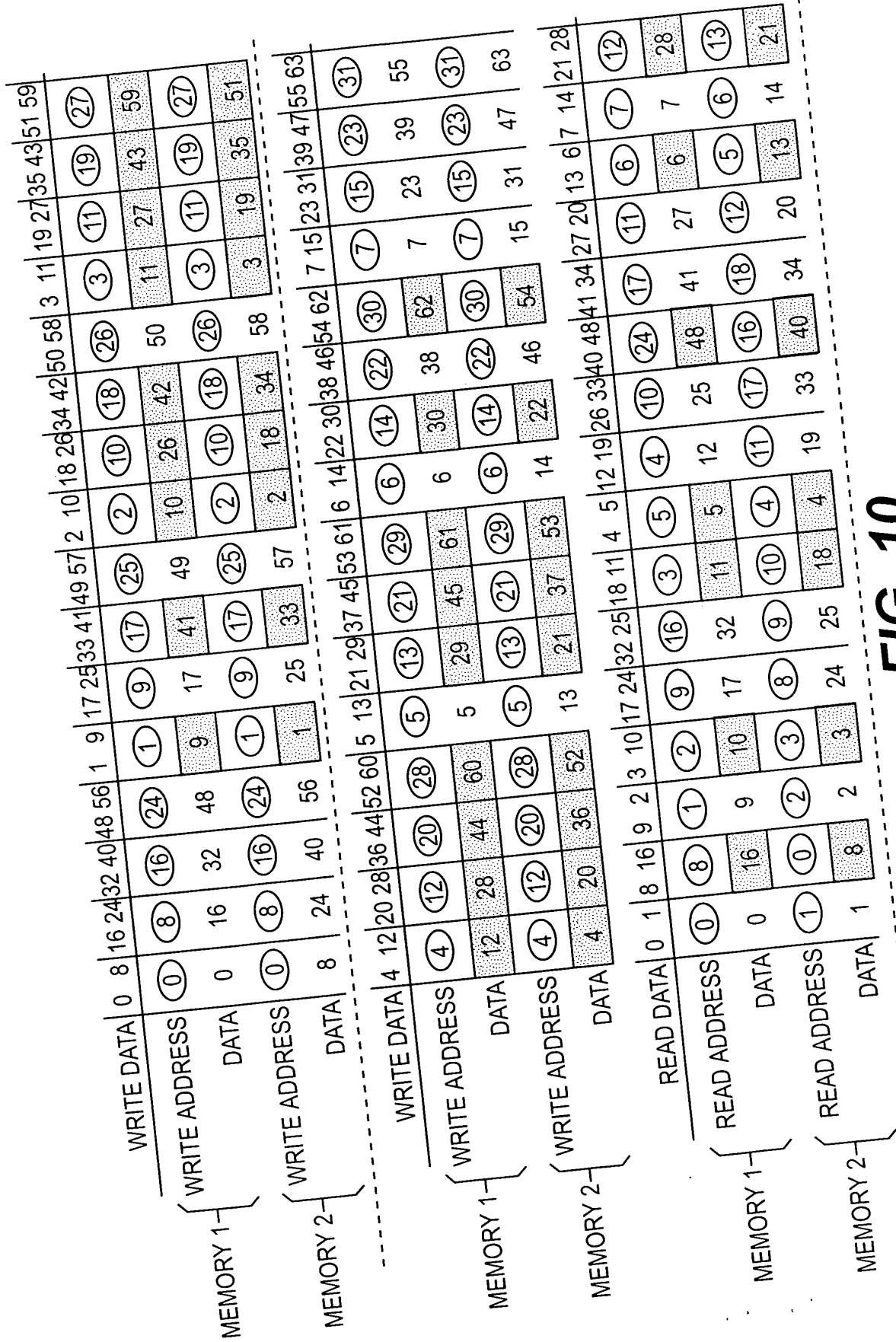


FIG. 10

WRITE DATA		0	8	16	24	32	40	48	56	1	9	17	25	33	41	49	57	2	10	18	26	3	11	19	27	35	43	51	59			
MEMORY 1	WRITE ADDRESS	0	8	16	24	32	40	48	56	1	9	17	25	33	41	49	57	2	10	18	26	3	11	19	27	35	43	51	59			
	DATA	0	16	32	48	16	32	48	24	9	17	25	33	41	49	57	2	10	26	42	50	11	27	43	59	27	59	27	59			
	WRITE ADDRESS	0	8	16	24	32	40	48	56	1	9	17	25	33	41	49	57	2	10	18	26	3	11	19	27	35	43	51	59			
	DATA	8	24	40	56	16	32	48	24	1	9	17	25	33	41	49	57	2	18	34	58	3	19	35	51	58	58	58	58			
READ DATA		35	42	49	56	57	50	43	36	29	22	15	23	30	37	44	51	58	59	52	45	38	31	39	46	53	60	61	54	47	63	
MEMORY 2	READ ADDRESS	18	25	26	19	13	15	14	20	27	21	22	23	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
	DATA	42	49	50	43	29	23	30	44	59	45	38	39	46	53	60	61	54	47	63	58	52	31	46	53	60	61	54	47	63	63	
	READ ADDRESS	19	24	25	20	14	7	21	27	26	28	15	22	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
	DATA	35	56	57	36	22	15	37	51	58	52	31	46	53	60	61	54	47	63	58	52	31	46	53	60	61	54	47	63	63	63	63

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	17	18	19	20	21	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

FIG. 12(a)

B0	0	25	2	19	4	13	14	15
B1	8	9	50	59	12	5	6	7
B2	16	17	10	11	20	21	30	23
B3	24	1	18	3	28	37	22	47
B0	40	57	58	35	44	53	38	55
B1	32	41	42	51	60	29	46	63
B2	48	49	26	43	52	61	62	31
B3	56	33	34	27	36	45	54	39

FIG. 12(b)

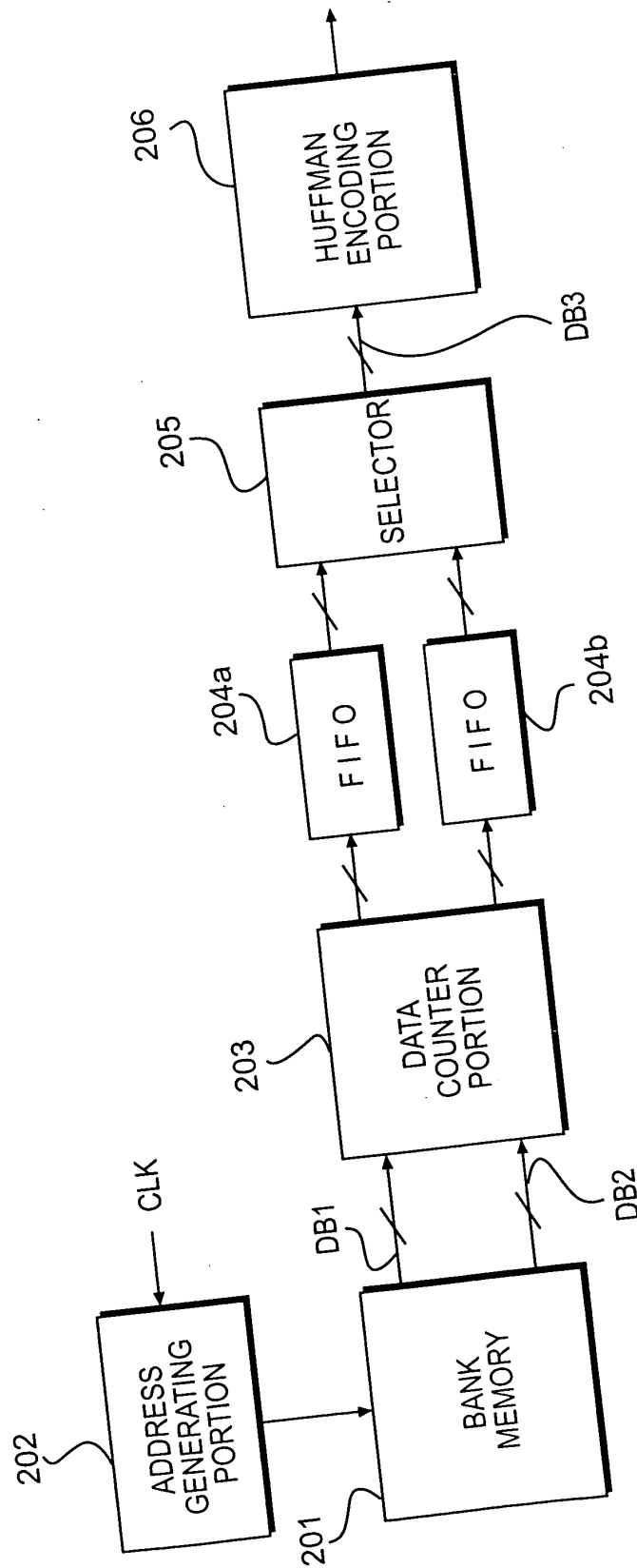


FIG. 13

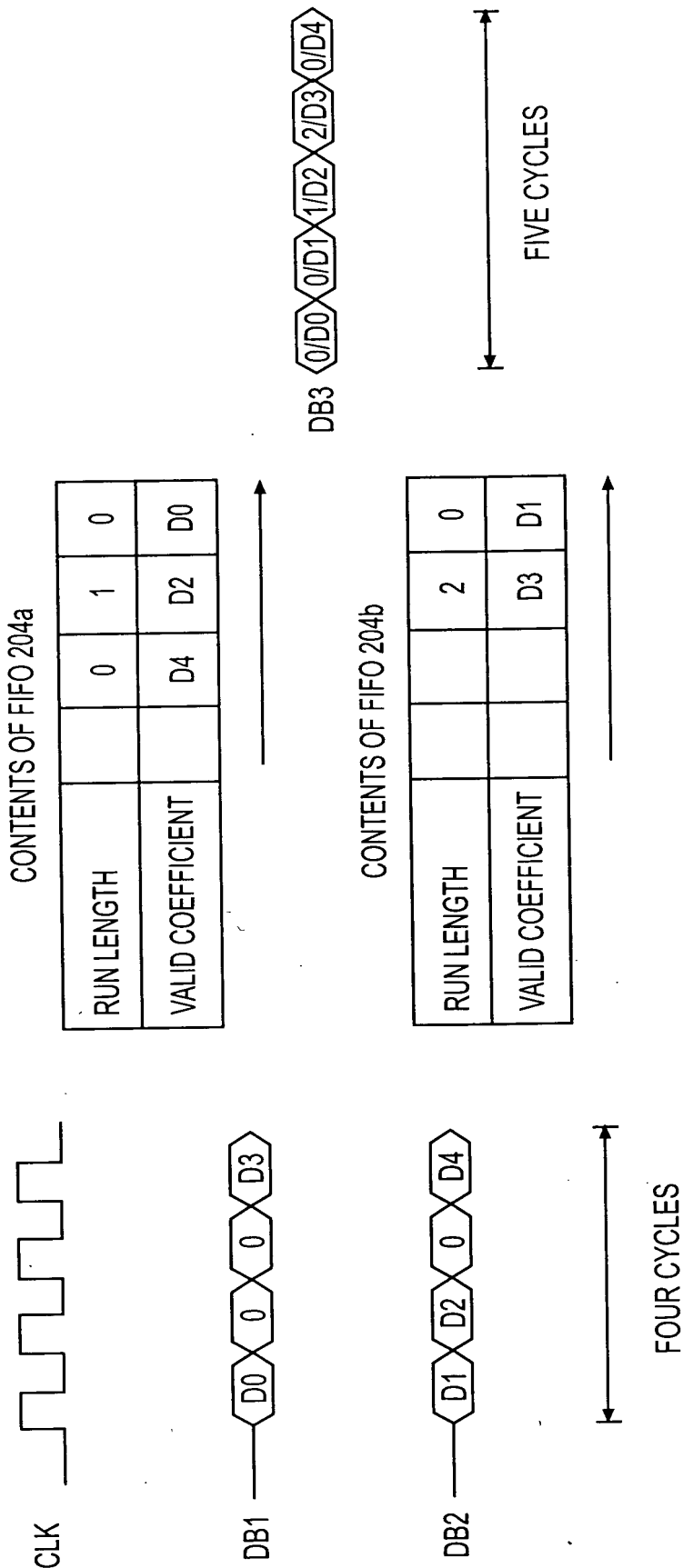


FIG. 14 (a)

FIG. 14 (b)

FIG. 14 (c)

FIG. 15

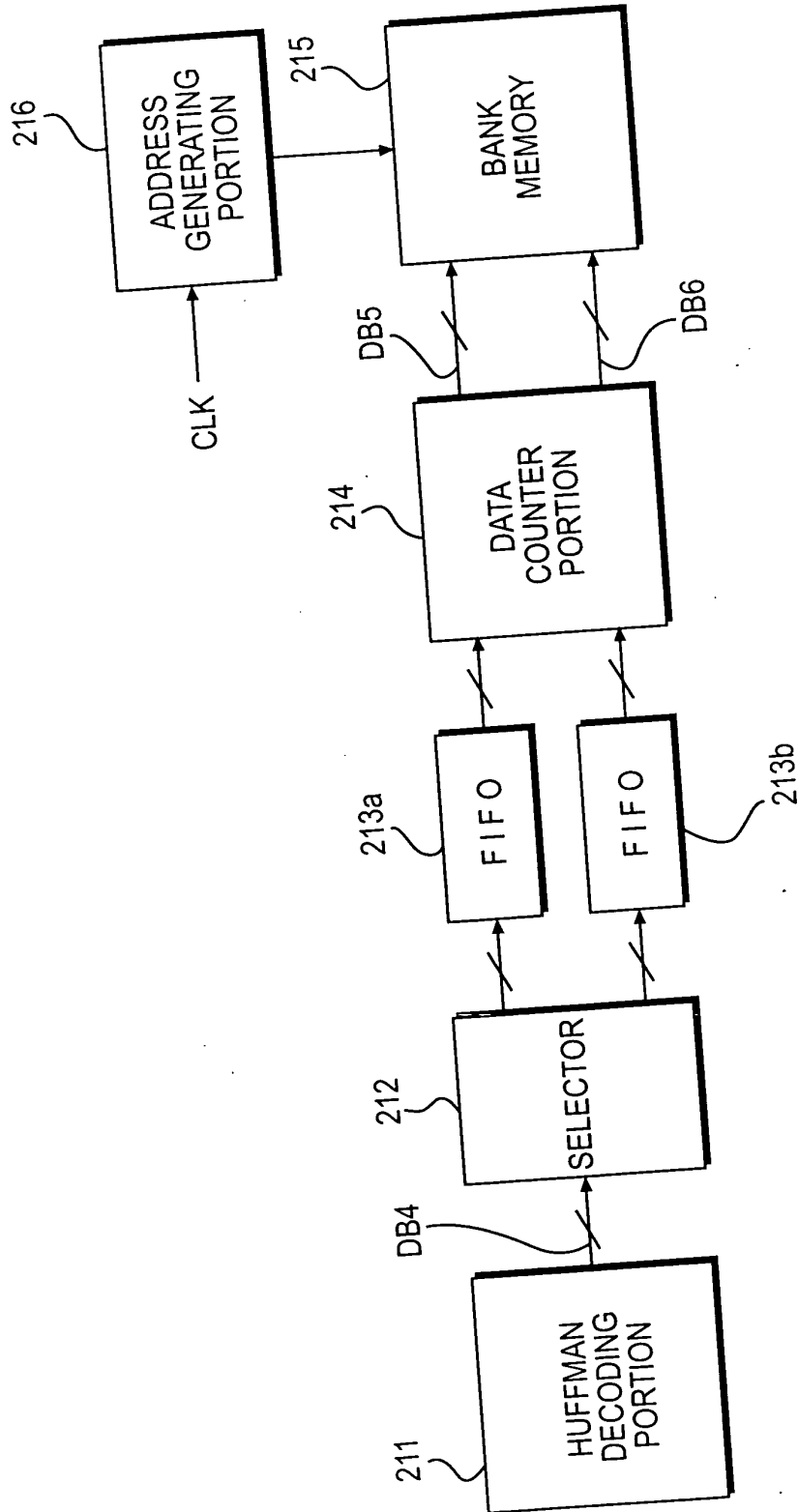


FIG. 15

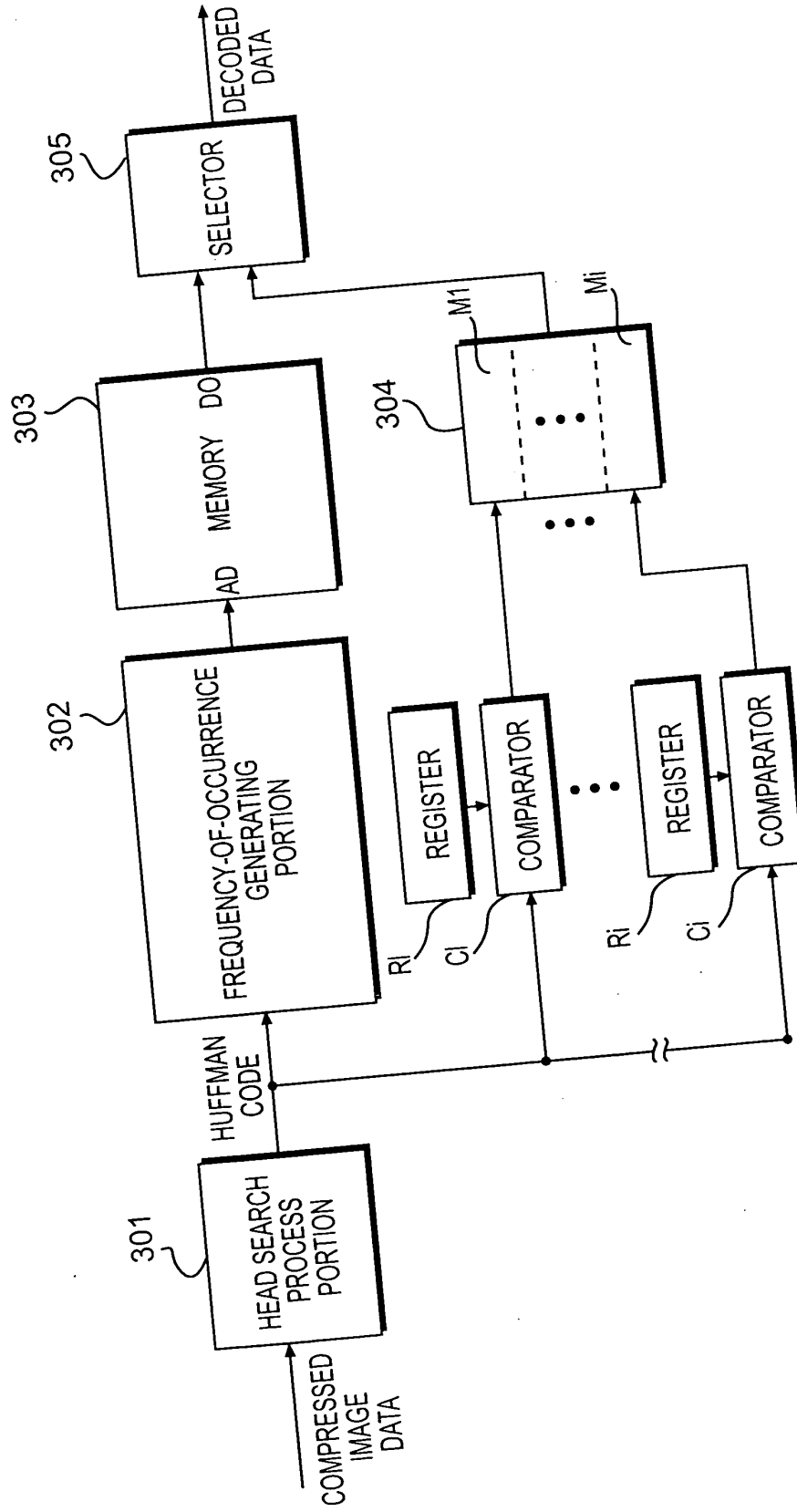
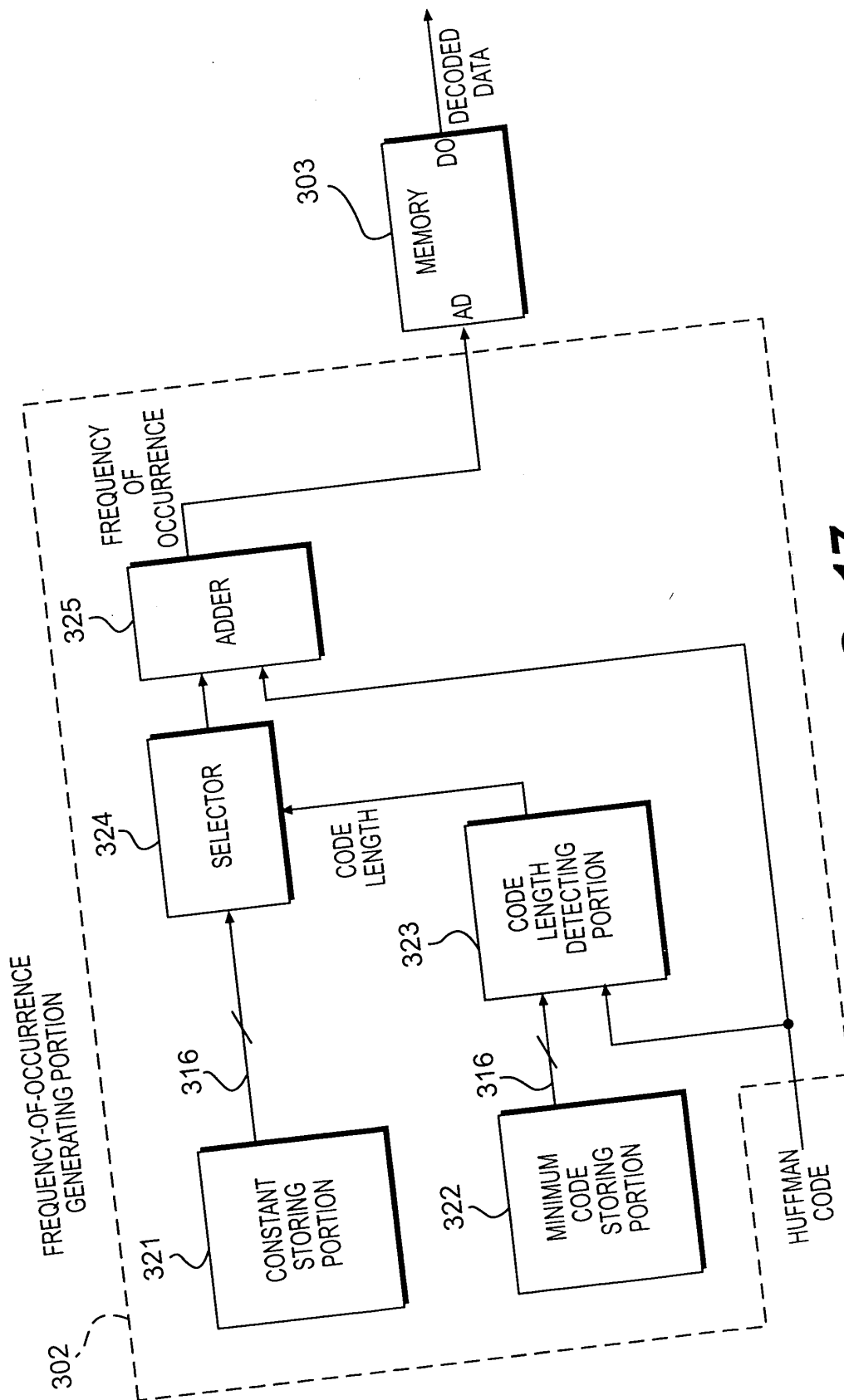


FIG. 16

102290-1242960

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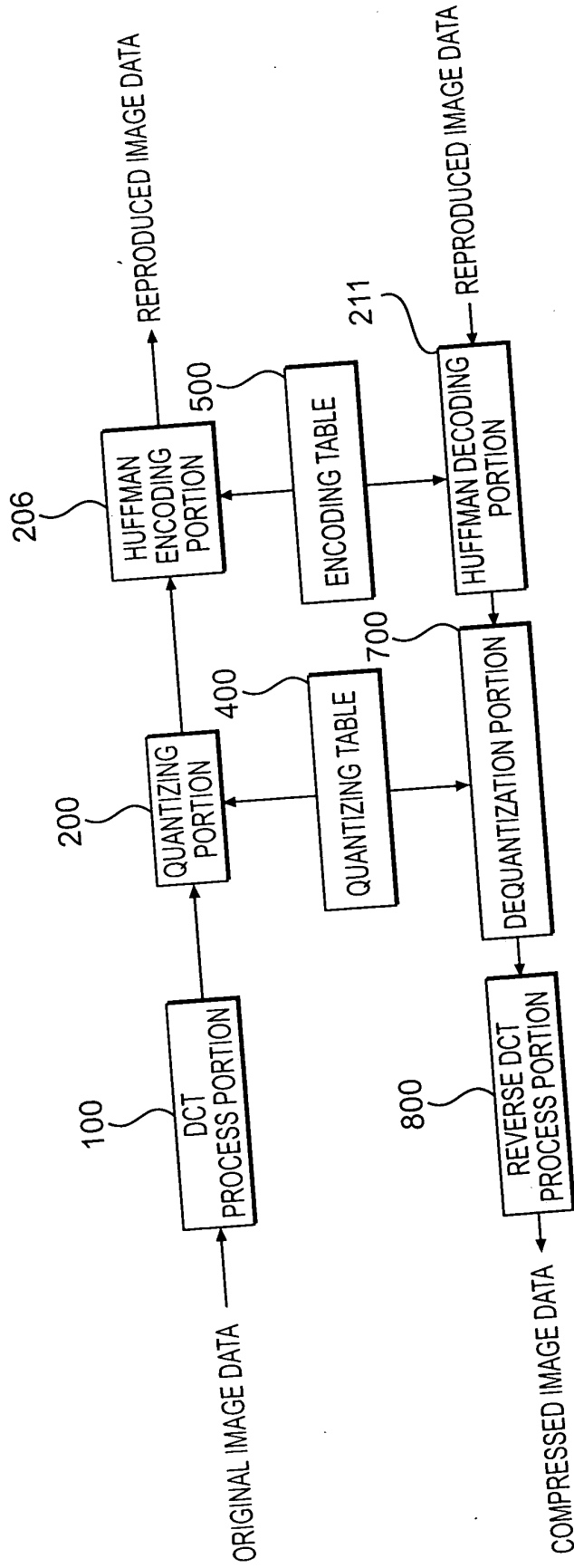
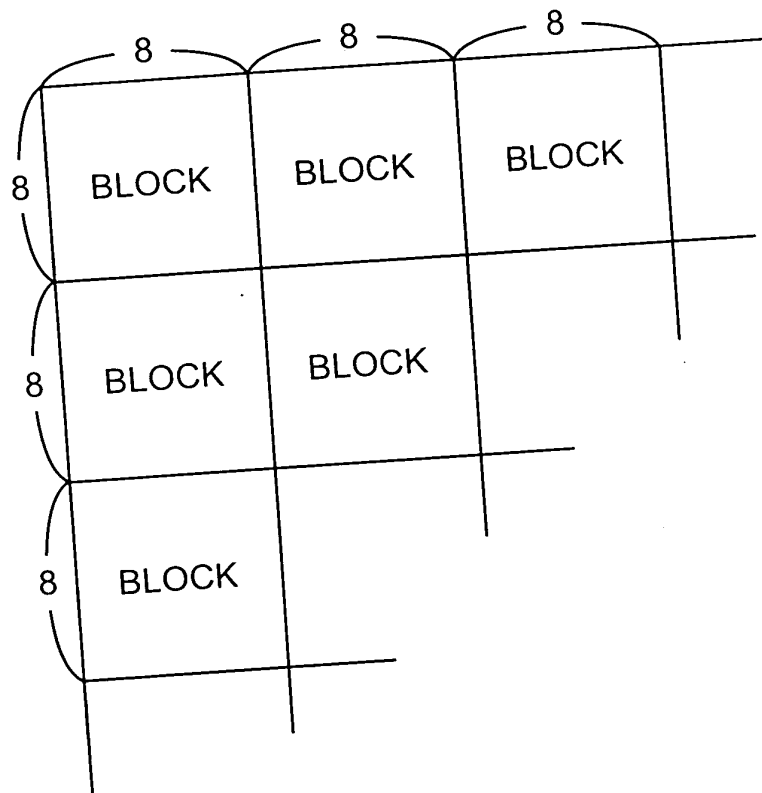
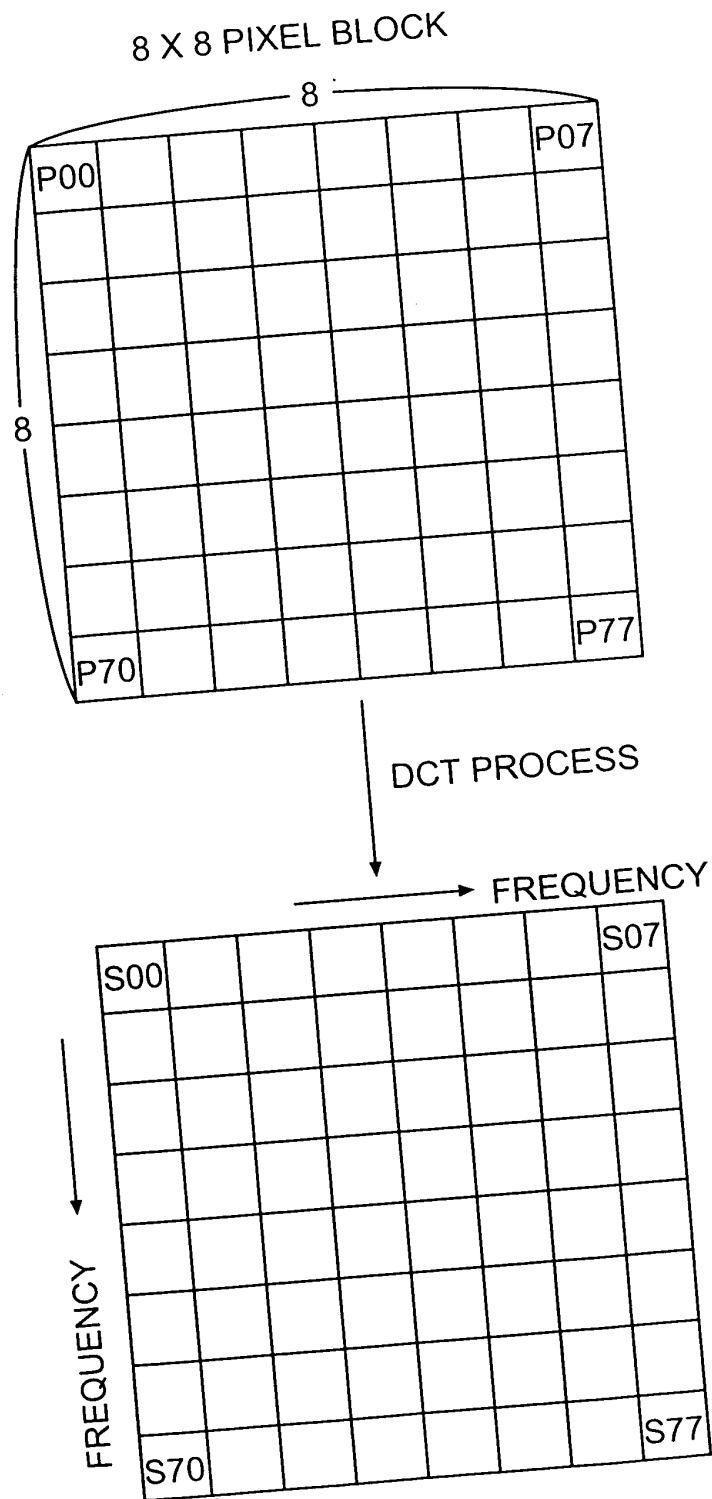


FIG. 18

FORMATION OF BLOCKS OF IMAGE DATA

**FIG. 19**

**FIG. 20**

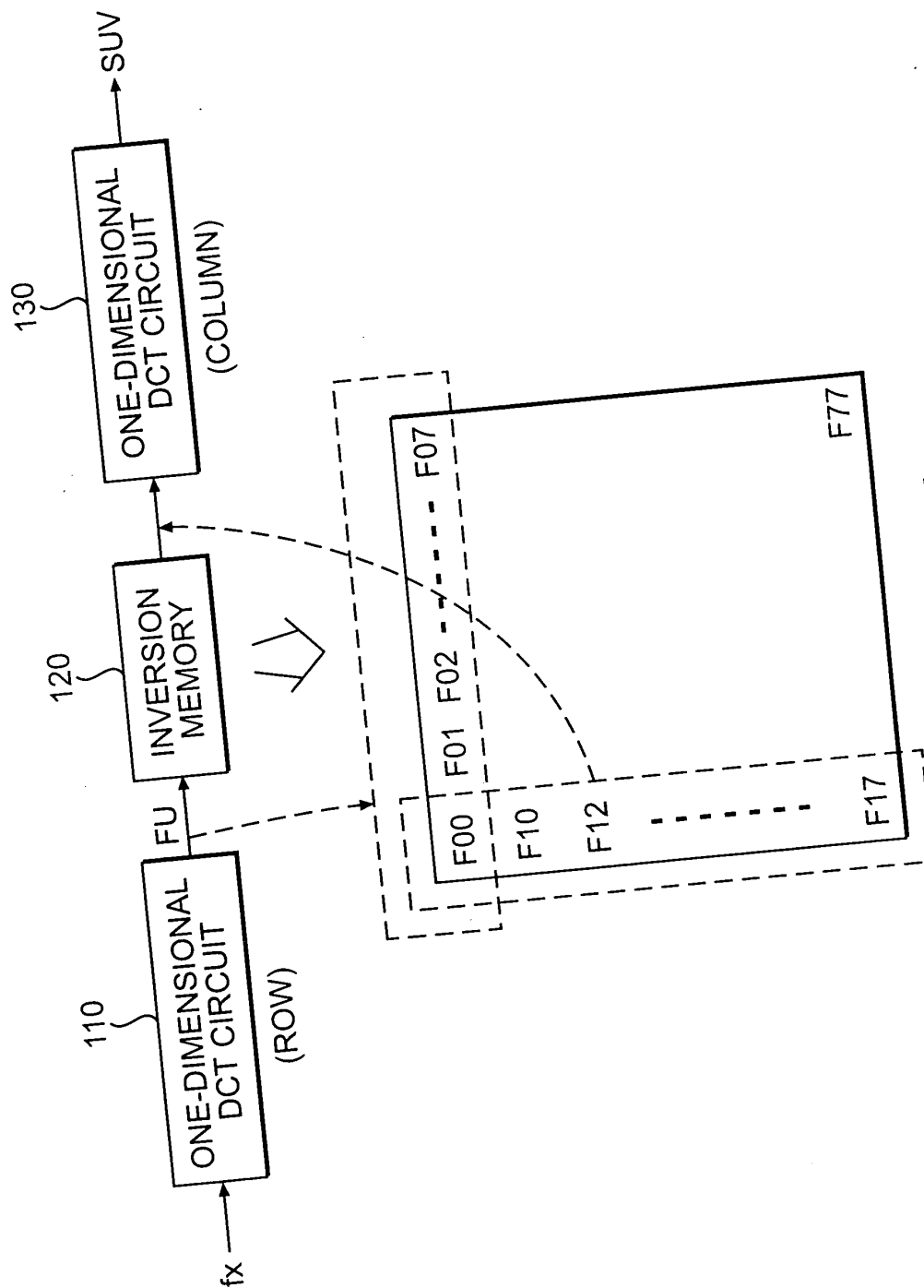
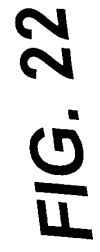


FIG. 21

SECRET

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED
DATE 08-19-2006 BY 60322 UCBAW/BJS

SECRET



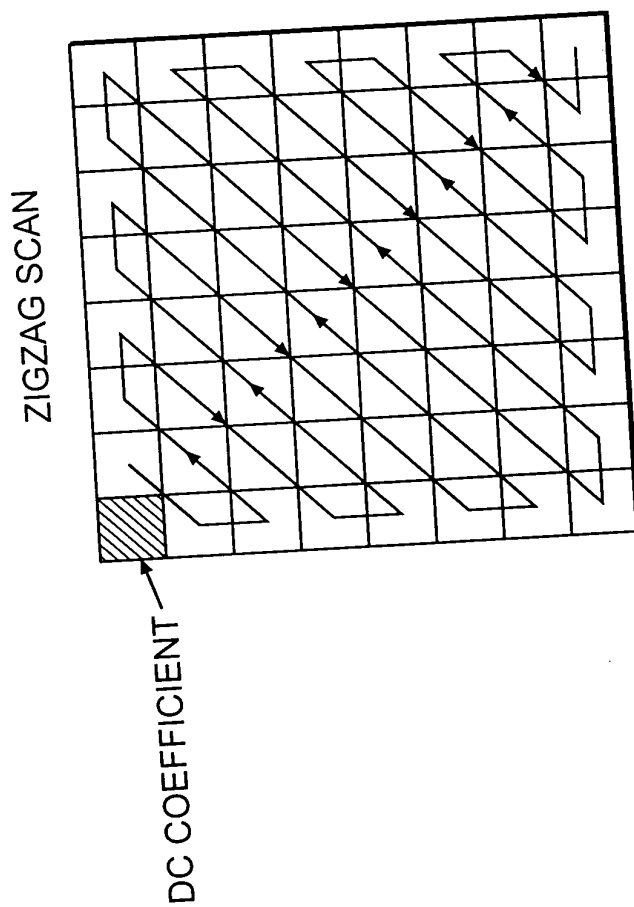


FIG. 23

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TM

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

RASTER SCAN (DIRECTION OF ROWS)

FIG. 24(a)

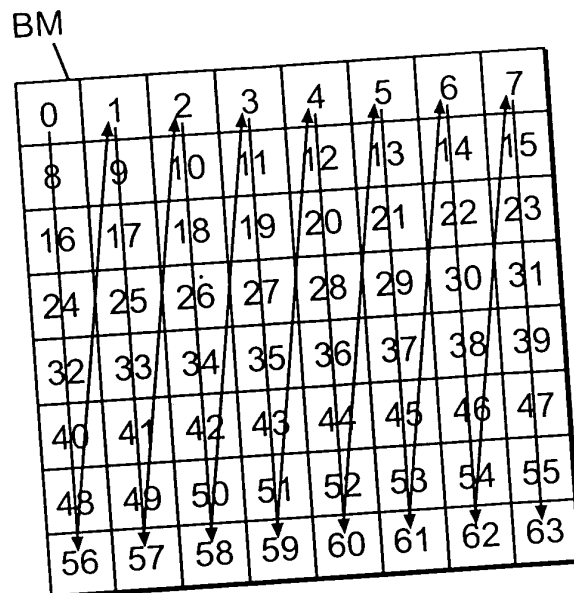
TM

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

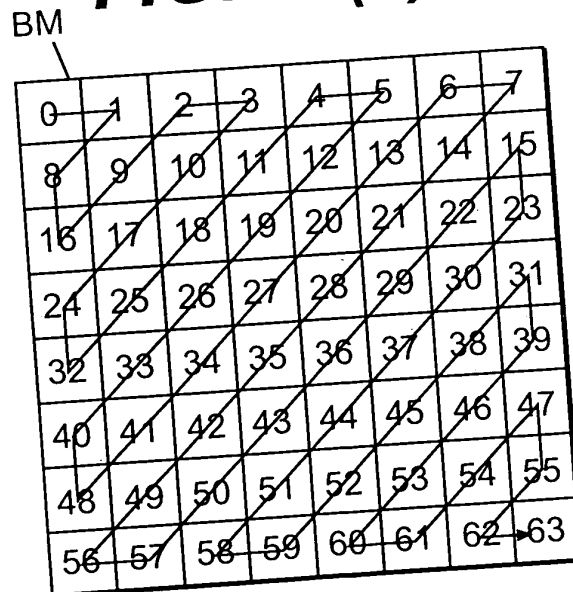
RASTER SCAN (DIRECTION OF COLUMNS)

FIG. 24(b)

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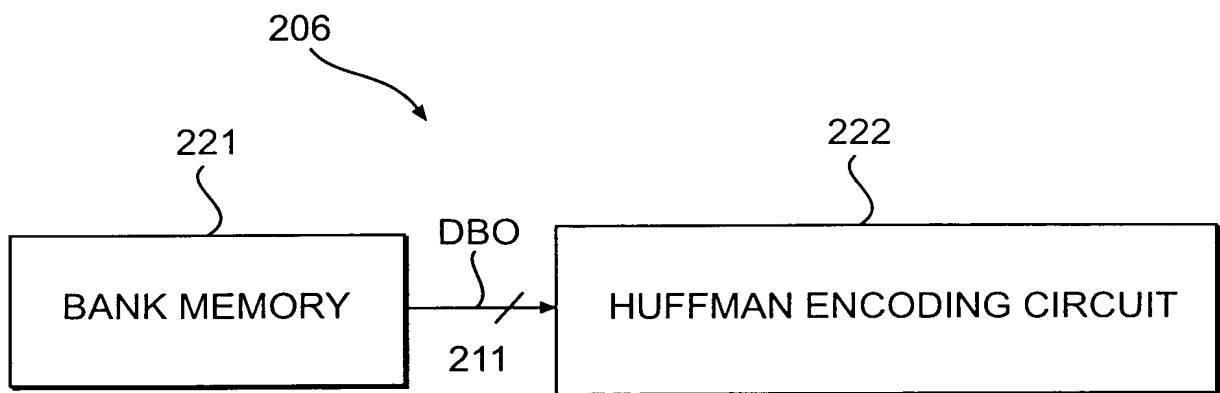


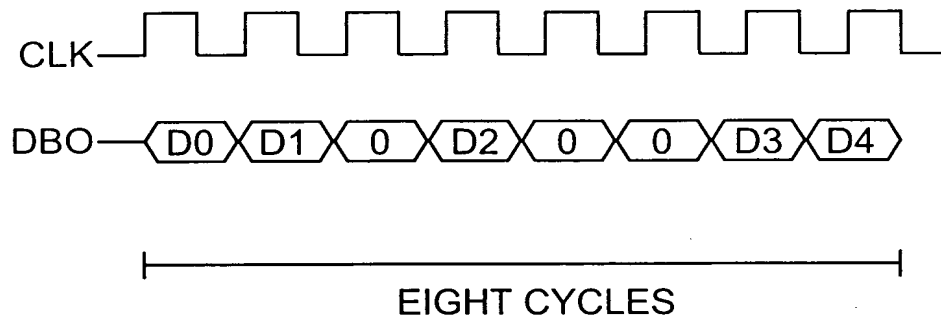
RASTER SCAN (DIRECTION OF ROWS)

FIG. 25(a)

ZIGZAG SCAN (DIRECTION OF COLUMNS)

FIG. 25(b)

**FIG. 26**

**FIG. 27**

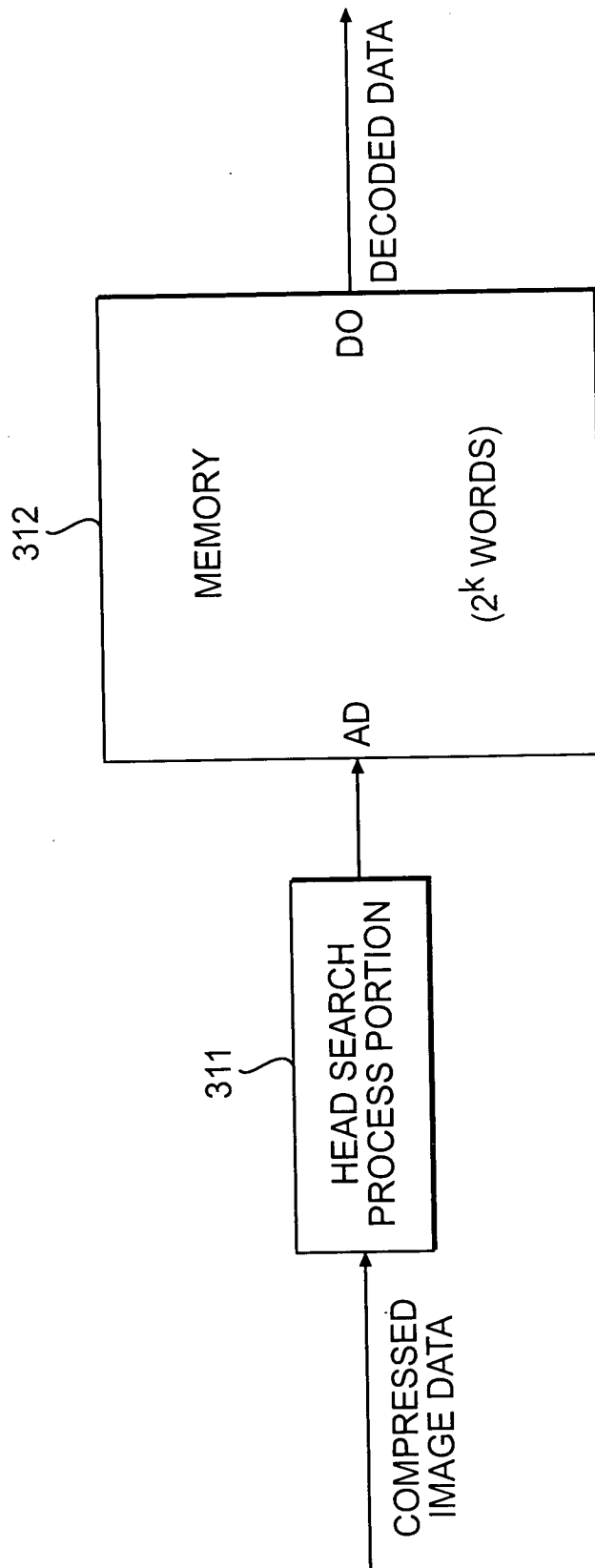


FIG. 28